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AN INVESTIGATION OF THE BLOOD SERUM PROTEINS BY THE
ELECTROPHORESIS METHOD IN CONNECTION WITH GASTRIC
RESECTION AND BLOOD TRANSFUSION

By S. D. Polozhentsev

- USSR -

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AN INVESTIGATION OF THE BLOOD SERUM PROTEINS BY THE
ELECTROPHORESIS METHOD IN CONNECTION WITH GASTRIC
RESECTION AND BLOOD TRANSFUSION

Following is the translation of an article
by S. D. Polozhentsev entitled "Issledovaniye
Syvorotochnykh Belkov Krovi Metodom Elektro-
foreza v Svyazi s Rezektsiyey Zheludka i
Perelivaniyem Krovi" (English version above)
in Vestnik khirurgii imeni I. I. Grekova
(Herald of Surgery imeni I. I. Grekova),
Vol. LXXXIV, No. 5, 1960, pages 60-63.

From Faculty Surgical Clinic No. 2 (Director - Prof.
M. S. Lysitsyn) of Military-Medical Order of Lenin Academy
imeni S. M. Kirov.

Soviet physiologists (I. P. Razenkov and coworkers)
have shown the great role of the gastro-intestinal tract,
particularly the stomach, in protein metabolism by their
experimental data and clinical observations. The study of
the state of the protein fractions of the blood in the pre-
sence of diseases of the gastro-intestinal tract and after
operation on it, particularly after resection of the stom-
ach, consequently is of particular interest.

The investigation of the blood serum proteins by the
method of electrophoresis on paper by virtue of its accessi-
bility, methodological simplicity, and the persuasiveness
of its results is obtaining ever wider dissemination in the
complex objective examination of the patient.

The literature data pertaining to the question being
studied and, in particular, in relation to ulcer disease,
which is one of the fundamental indications for resection of
the stomach, are not numerous and have a contradictory
character. Some authors (Khr. Brailski and S. Samsonova)
speak of changes of the content of the total blood serum
protein in the presence of ulcer disease due to the lower-
ing of the alpha-1, alpha-2 and beta-globulin fractions in
the presence of a relative increase in the gamma-globulins.
L. V. Popel' notes a lowering of the alpha-globulin fraction
in patients suffering from ulcer disease. G. K. Urbanyuk

communicates that the total blood serum protein in patients with ulcer disease remains in the limits of normal or is even increased in the presence of a regular increase of the alpha-1 and alpha-2 globulins.

In the work of F. F. Dragel' the investigation of the blood serum proteins in patients in connection with gastric resection operations was conducted by the method of salting out, which does not make it possible to study the globulin subfractions, the study of which has significance in the study of the immunobiological shifts in the organism in connection with operative intervention.

The object of the investigation which was conducted was the study of the correlations of the protein fractions of blood serum in patients with ulcers of the stomach and the duodenum in the presence of conservative treatment and in connection with the gastric resection operation, and also the influence on the content of the protein fractions of blood transfusion, the erythrocytic mass, and aminokrovin [a protein hydrolyzate used as blood substitute] which are widely used in gastric resections.

The investigation of the protein fractions of the blood serum was conducted by the method of electrophoresis on paper in the B. N. Ushakov modification.

We succeeded in achieving a clear-cut division of the protein fractions (see the figure) of the blood serum, which appeared to be a guarantee of the reproducibility of the data, i. e., parallel determinations of the protein fractions of one and the same serum gave results which almost coincided.

The total protein was determined refractometrically. The work consisted of three sections in which the following were studied: 1) the change of the protein fractions of the blood serum in the presence of ulcers; 2) the change of the protein fractions in the presence of the gastric resection operation and in various periods after it; 3) the influence on the protein fractions of blood transfusions, the electrocytic mass, and aminokrovin.

In all, 69 patients and 15 healthy individuals were examined; 230 investigations of the blood serum protein fractions were conducted by the method of electrophoresis on paper.

On the basis of the observations which were conducted, the following results were obtained.

1. In the examination of the 15 healthy individuals, the average content of the total blood serum protein amounted to 7.5%; of albumins -- 62% (of the total protein); of globulins -- 38%, of which alpha-1 globulins amounted to 4%, the alpha-2 globulins to 6%, the beta globulins to 12%, and

the gamma globulins to 16%.

2. The content of the total blood serum protein in the 41 ulcer patients examined was in normal limits (6.5-8g%). In 19 of these individuals the ratio of the protein fractions was normal. Dysproteinemia was observed in 22 patients and in nine individuals it proceeded at the expense of an increase in the alpha-2 and gamma-globulins in the presence of a lowering of the albumin fraction, in nine -- at the expense of an increase in the gamma-globulins, and in four only the alpha-2 globulins were raised. The maximal changes in relation to the protein fractions was observed in patients with a severe clinical course of the ulcers and, particularly, in the presence of complications.

3. Twenty-one patients were examined in connection with the gastric resection operation. For 11 of them, the operation was conducted on account of ulcers, for six -- on account of polyposis of the stomach and for four -- on account of cancer of the stomach.

The patients were examined before the operations, several times at the time of the operation and at various periods after it.

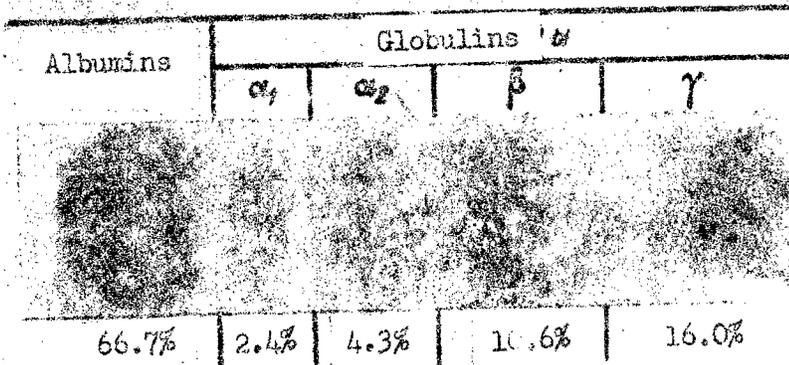
In the postoperative period a fall in the content in the blood serum of total protein was noted and, independently of the serum picture before the operation, a considerable increase in the alpha-2 globulins was noted.

In the first days after the operation the gamma-globulins were within normal limits or below them. Subsequently, on the third to the tenth day, an increase in the percentage content of gamma-globulins was observed; the latter was raised above normal, which argues in favor of a mobilization of the protective forces of the organism for the struggle against the sequelae of operative trauma. A year and more after the operation, in the four individuals with a smooth postoperative course, a normal ratio of the blood serum protein fractions was noted. In the two patients with disease of the operated stomach, there was observed an increase in the content of alpha-2-globulins, and in one patient in the presence of cancer of the stump of the stomach, the percentage of gamma-globulins was increased.

4. The investigation of the blood serum proteins was conducted in 20 cases of transfusion of blood, erythrocytic mass, and aminokrovin to patients suffering with ulcers or other gastric diseases. Of these, blood was transfused in 10 cases, erythrocytic mass in five cases, and aminokrovin in five cases. The blood of the subjects was taken before transfusion, after two hours, and a day after the transfusion.

In the presence of the transfusion of blood, erythro-

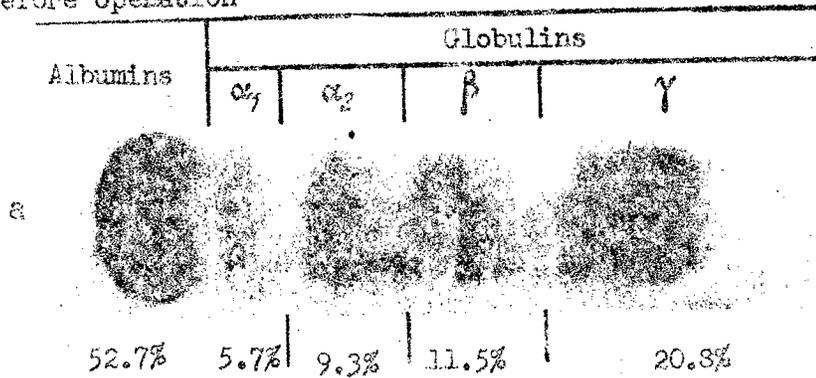
I Electrophoreproteinogram of a healthy individual



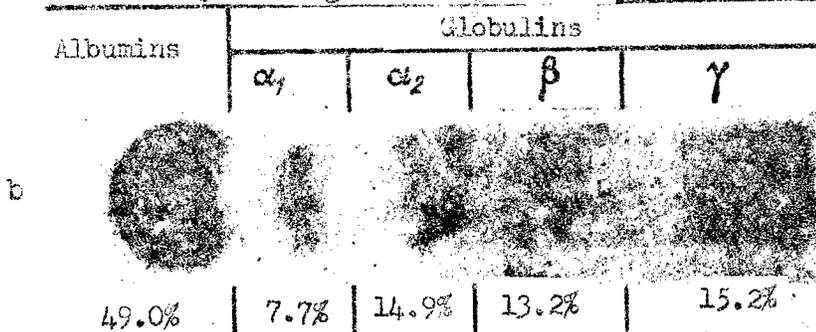
II Electrophoreproteinogram of patient K.

Diagnosis: Ulcers of the stomach

Before operation



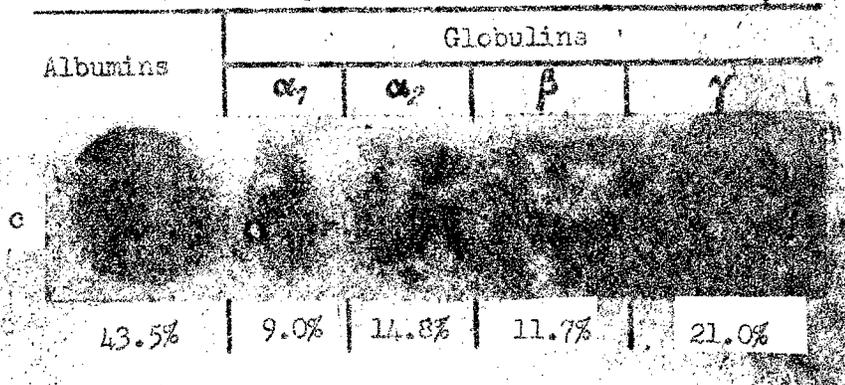
Second day after gastric resection



[Continued next page]

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Sixth day after operation



Electrophore proteinograms of human blood serum.
(Method of investigation as modified by B. N. Ushakov).

I -- electrophore proteinogram of a healthy individual with a normal ratio of the blood serum protein fractions; II -- electrophore proteinograms of patient K., suffering from ulcers:
a -- before operation: a diminution of the albumins at the expense of an increase in the α_2 and γ -globulins is observed; b -- on the second day after the gastric resection operation: the content of α_2 -globulins is sharply increased, while the γ -globulins are lowered below normal; c -- Sixth day after resection: the quantity of γ -globulins has grown above normal.

cytic mass and aminokrovin, the total protein figures were either increased or remained normal.

In patients with a normal ratio of the blood serum protein fractions, the serum formula was retained even after the transfusion.

In patients with dysproteinemia in the majority of cases a tendency toward normalization of the ratio of the protein fractions was observed, and this occurred in a more pronounced fashion in the presence of the transfusion of blood, than in the presence of the transfusion of erythrocytic mass and aminokrovin.

Consequently, for diminishing dysproteinemia and raising the protective properties of the organism, it is more expedient for patients with gastric resection in the postoperative period to conduct blood transfusion, than transfusion of erythrocytic mass and aminokrovin.

Conclusions

1. In patients with a pronounced clinical picture of ulcer disease and particularly in the presence of complications, dysproteinemia is noted in the form of a diminution of the percent content of albumins and an increase in the content of alpha-2 and gamma-globulins. The degree of these changes can serve as a supplementary criterion of the severity of the disease and of the necessity of operative intervention.

2. In patients after the gastric resection operation, an increase in the content of alpha-2-globulins, and initially a diminution, and then an increase in the content of gamma-globulins was noted, which reflects the immunobiological shifts in the organism in the postoperative period.

3. Under the influence of transfusion of amino acids, erythrocytic mass, and particularly, of blood, the dysproteinemia has a tendency toward smoothing over.

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